

CLAIMS

I claim:

- 1 1. An apparatus comprising:
2 an elongate member having dimensions suitable for
3 insertion into a body;
4 at least one thermally conductive heating element
5 coupled to a portion of the elongate member, the heating
6 element comprising material whose electrical resistance
7 changes in response to a change in temperature; and
8 an anemometry circuitry interface electrically coupled
9 to the heating element.
- 1 2. The apparatus of Claim 1, wherein the elongate
2 member comprises a needle.
- 1 3. The apparatus of Claim 2, wherein the needle has
2 an outer diameter between 0.009 inches and 0.134 inches.
- 1 4. The apparatus of Claim 2, wherein the needle
2 comprises a material of at least one of stainless steel and
3 ceramic.
- 1 5. The apparatus of Claim 1, wherein the elongate
2 member is a rod.
- 1 6. The apparatus of Claim 1, wherein the heating
2 element comprises at least one of a wire, a film, and a
3 thermistor material.
- 1 7. The apparatus of Claim 1, wherein the heating
2 element has a length which is approximately equal to or less
3 than a known tissue thickness.

1 8. The apparatus of Claim 7, wherein the length of
2 the heating element is between 0.010 inches and 0.400
3 inches.

1 9. The apparatus of Claim 1, wherein the anemometry
2 circuitry interface comprises:

3 a first electrically conductive lead electrically
4 coupled to a first end of the heating element; and
5 a second electrically conductive lead electrically
6 coupled to a second end of the heating element.

1 10. The apparatus of Claim 1, wherein a portion of the
2 elongate member comprises an electrically conductive
3 material and wherein the anemometry circuitry interface
4 comprises:

5 an electrically conductive lead electrically coupled to
6 a first end of the heating element, and
7 the elongate member electrically coupled to a second end of
8 the heating element.

1 11. An apparatus comprising:

2 a needle having dimensions suitable for insertion into
3 a body;

4 at least one thermally conductive heating element
5 coupled to a portion of the needle, the heating element
6 comprising material whose electrical resistance changes in
7 response to a change in temperature; and

8 anemometry circuitry electrically coupled to the
9 heating element.

1 12. The apparatus of Claim 11, wherein the needle has
2 an outer diameter between 0.009 inches and 0.134 inches.

1 13. The apparatus of Claim 11, wherein the needle
2 comprises a material of at least one of stainless steel and
3 ceramic.

1 14. The apparatus of Claim 11, wherein the heating
2 element comprises at least one of a wire, a film, and a
3 thermistor material.

1 15. The apparatus of Claim 11, wherein the heating
2 element has a length which is approximately equal to or less
3 than a known tissue thickness.

1 16. The apparatus of Claim 15, wherein the length of
2 the heating element is between 0.010 inches and 0.400
3 inches.

1 17. The apparatus of Claim 11, wherein the anemometry
2 circuitry is electrically coupled to a first end of the
3 heating element by a first electrically conductive lead and
4 is electrically coupled to a second end of the heating
5 element by a second electrically conductive lead.

1 18. The apparatus of Claim 11, wherein a portion of
2 the elongate member comprises an electrically conductive
3 material and wherein the anemometry circuitry is
4 electrically coupled to a first end of the heating element
5 by an electrically conductive lead and is electrically
6 coupled to a second end of the heating element by the
7 elongate member.

1 19. The apparatus of Claim 11, wherein the anemometry
2 circuitry comprises:
3 a circuit having the heating element and a variable
4 resistor as resistive circuit elements; and
5 an amplifier electrically coupled to the circuit

6 to sense the difference in voltage drop across the
7 heating element and the variable resistor caused by the
8 difference between a first resistance of the heating element
9 and a resistance of the variable resistor,

10 to amplify the voltage difference, and
11 to input the amplified voltage difference back to
12 the circuit to cause a modification of a temperature of the
13 heating element such that the heating element assumes a
14 second resistance.

1 20. The apparatus of Claim 19, wherein a plurality of
2 heating elements are coupled along a length of the elongate
3 member, and further comprising:

4 anemometry circuitry separately coupled to each of the
5 heating elements such that the heat dissipation
6 characteristics measured by the plurality of anemometry
7 circuits can be used to determine at least one of injection
8 depth and tissue type.

1 21. A method comprising:

2 introducing a heat dissipation measurement device into
3 a body comprising tissue; and

4 determining at least one of injection depth and tissue
5 type based on measured heat dissipation characteristics of
6 the tissue.

1 22. The method of Claim 21, further comprising
2 identifying a location of at least one tissue/tissue
3 interface.

1 23. The method of Claim 22, wherein the heat
2 dissipation measurement device comprises at least two
3 thermally conductive heating elements and wherein
4 identifying comprises:

5 inserting the heat dissipation measurement device into
6 a first tissue such that a first heating element is disposed
7 within the first tissue and positioned to measure heat
8 dissipation characteristics of the first tissue; and

9 moving the heat dissipation measurement device further
10 into the body such that

11 the first heating element is disposed in a second
12 tissue and positioned to measure heat dissipation
13 characteristics of the second tissue, and

14 a second heating element is disposed in the first
15 tissue and positioned to measure heat dissipation
16 characteristics of the first tissue.

1 24. The method of Claim 23, wherein the first tissue
2 is one of a vessel wall and a blood volume and the second
3 tissue is the other of the vessel wall and the blood volume.

1 25. The method of Claim 23, wherein the first tissue
2 is one of a cardiac muscle and a blood volume and the second
3 tissue is the other of the cardiac muscle and the blood
4 volume.